

# *Advance*

## **SIGNAL GENERATOR**

### **TYPE B4**

Including B4A, B4B, B4A/C and B4B/C

## **INSTRUCTION MANUAL**

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# *Advance*

## **SIGNAL GENERATOR TYPE B4**

(Including B4A: B4B: B4A/C: B4B/C)

**T**HE Advance Type B4 Signal Generator is available in two versions, the B4A and B4B, each providing a wide frequency range with accurate frequency and output voltage calibration.

The frequency ranges are 100 kc/s to 80 Mc/s on B4A, and 30 kc/s to 30 Mc/s on B4B. The accuracy of frequency calibration is  $\pm 1\%$ . A linear scale and vernier are provided to give very close resetting accuracy. Due to the use of a crystal voltmeter followed by our type A.38 high frequency resistive attenuator, the output is measured to  $\pm (1 \text{ dB} + 2\% \text{ F.S.D.})$ .

The signal can be modulated internally at 400 c/s from 0 to 80%. External modulation, also 0 to 80%, may be applied up to 30 kc/s into the B4A and up to 10 kc/s into the B4B. Both internal and external modulation depths are monitored.

The instruments are of robust construction and are simple to operate.

# SPECIFICATION

## FREQUENCY

Frequency ranges.

**B4A/C** 100 kc/s to 80 Mc/s in 6 ranges. Accuracy  $\pm 1\%$ .

Range A: 100–300 kc/s. Range D: 3–10 Mc/s.

Range B: 300–1000 kc/s. Range E: 10–30 Mc/s.

Range C: 1–3 Mc/s. Range F: 30–80 Mc/s.

**B4B/C** 30 kc/s to 30 Mc/s in 6 ranges. Accuracy  $\pm 1\%$ .

Range A: 30–100 kc/s. Range D: 1–3 Mc/s.

Range B: 100–300 kc/s. Range E: 3–10 Mc/s.

Range C: 300–1000 kc/s. Range F: 10–30 Mc/s.

## R.F. OUTPUT VOLTAGE Accuracy $\pm (1 \text{ dB} + 2\% \text{ F.S.D.})$ .

The output voltage from the 75 ohm attenuator is fed into a 75 ohm transmission line which is terminated with a 75 ohm dummy aerial pad. The output into 75 ohms is continuously variable from  $1\mu\text{V}$  to 100mV by means of a 4-step decade attenuator and a continuously variable control. The signal is monitored after the variable control to ensure accuracy at high frequencies.

## OUTPUT IMPEDANCE

The output impedance at the end of the unterminated transmission line is 75 ohms. When terminated by the Termination Pad type TP1A supplied with the instrument, three impedance values are available:—

- (1) 37 ohms (with full output).
- (2) 10 ohms (with one-tenth indicated output).
- (3) A standard dummy aerial (with one-tenth indicated output).

## INTERNAL MODULATION

Frequency 400 c/s  $\pm 10\%$ .

Modulation depth 0 to 80%;  $\pm 1 \text{ dB} \pm 2\% \text{ F.S.D.}$

## EXTERNAL MODULATION

**B4A** 10 c/s to 30 kc/s, 0 to 80% for frequencies less than 1/30th of the carrier frequency.

**B4B** 10 c/s to 10 kc/s, 0 to 80% for frequencies less than 1/30th of the carrier frequency.

Approximately 10% modulation depth per volt input into high impedance is obtained. The modulation depth is monitored. Accuracy  $\pm 1 \text{ dB}$ .

# SPECIFICATION

## A.F. OUTPUT

This is obtained from the internal modulation oscillator at approximately 400 c/s. Output is approximately 0 to 10 volts into 600 ohms.

## R.F. LEAKAGE

Good screening and filtering have reduced stray radiation to less than  $1\mu\text{V}$ .

## ACCESSORIES

Each instrument is supplied with the following:—

- 1 ECC 91 Mullard valve (6J6)
- 1 6SN7GT valve
- 1 6X5GT valve
- 1 Pilot lamp, type M.E.S. 11 mm, 6.5 volts
- 1 Termination and Dummy Aerial Pad, type TP1A
- 1 Shielded R.F. Feeder, complete with plugs, type PL5
- 1 Shielded A.F. Lead, complete with plug and crocodile clips, type PL18
- 1 Mains Lead, type PL24

## POWER SUPPLY

**B4A, B4B:** 110, 210, 230, 250 volts 40–100 c/s.

Consumption approximately 25 watts.

A model is also available for 110–125, 140–160, 220 volts 40–100 c/s. and 117 volts 25–60 c/s.

## WEIGHT

25 lb (11.4 kg) nett

## DIMENSIONS

13 in.  $\times$  12 $\frac{3}{8}$  in.  $\times$  7 $\frac{1}{4}$  in. (33.0 cm  $\times$  31.4 cm  $\times$  18.4 cm)

## SPECIFICATION OF TERMINATION PAD TYPE TP1A

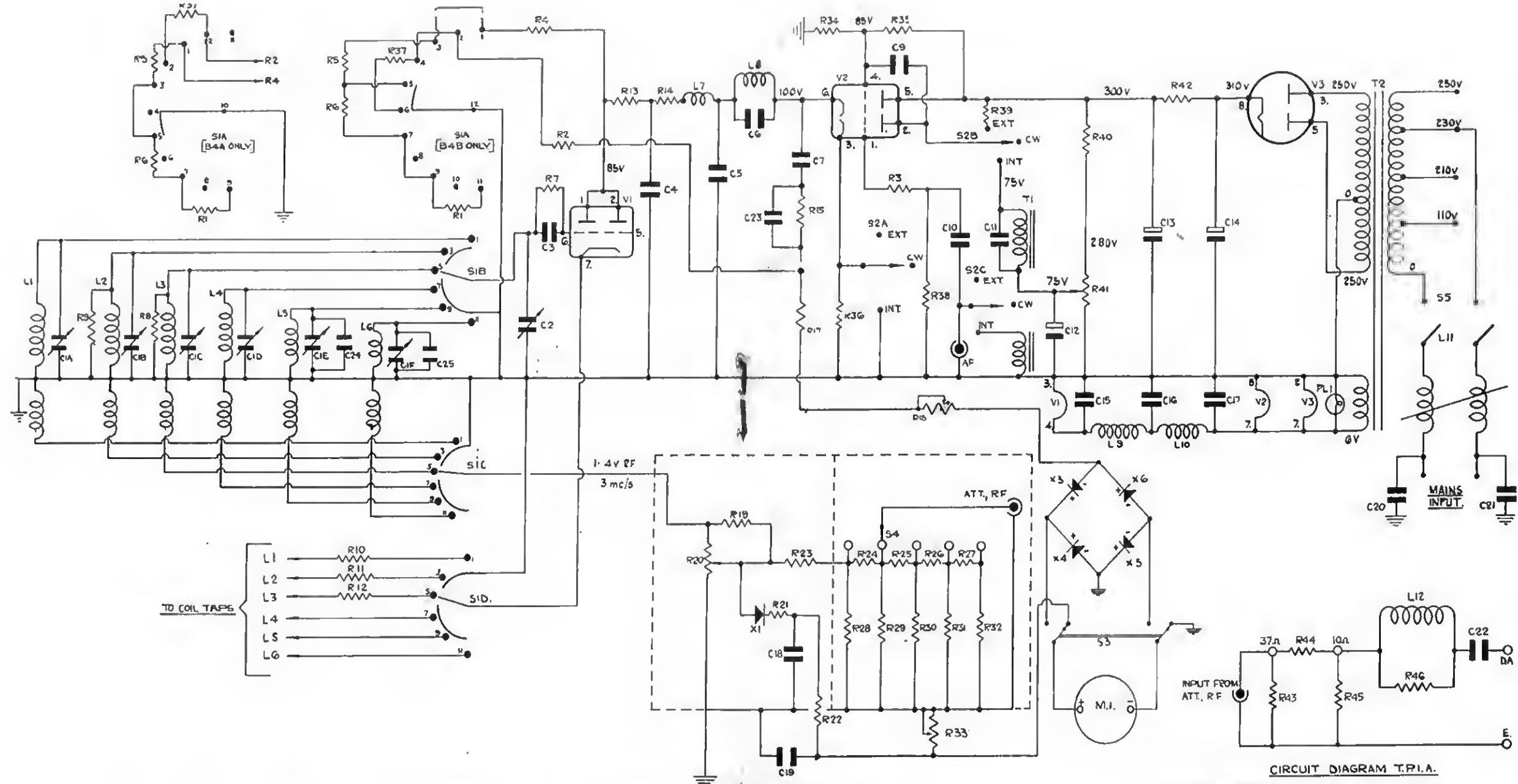
Input impedance 75 ohms.

Outputs: 37 ohms at full voltage.

10 ohms giving one-tenth of input voltage.

A standard dummy aerial giving one-tenth of input voltage.

The TP1A is shown on the circuit diagram.



CIRCUIT DIAGRAM T.P.I.A.

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THE RIGHT IS RESERVED TO ADJUST VALUES OR AMEND THIS CIRCUIT WITHOUT NOTICE

REF.	DESCRIPTION RESISTOR	PART No.	REF.	DESCRIPTION RESISTOR	PART No.	REF.	DESCRIPTION CAPACITORS	PART No.	REF.	DESCRIPTION	PART No.
R1	15K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1177	R34	1M $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1171	C1	A-F 3-30pF Concentric Trimmers	1620	L1	Oscillator Coil. 100-300 kc/s B4A	RF 541
R2	330K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	4408	R35	2-2M $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1180	C2	13-514pF Variable Condenser	7368	L2	Oscillator Coil. 30-100 kc/s B4B	RF 551
R3	10K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	671	R36	5-1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	7496	C3	100pF SILVERED MICA	7492	L3	Oscillator Coil. 300-1000 kc/s B4A	RF 542
R4	15K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	6381	R37	680K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	5024	C4	200pF 5% Silvered Mica on B4A	7493	L4	Oscillator Coil. 100-300 kc/s B4B	RF 541
R5	5-6K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1525	R38	1M $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1171	C5	750pF 5% Silvered Mica on B4B	7577	L5	Oscillator Coil. 1-3 Mc/s B4A	RF 543
R6	10K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	671	R39	100K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1270	C6	330pF 5% Silvered Mica on B4A	7489	L6	Oscillator Coil. 300-1000 kc/s B4B	RF 542
	15K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1177	R40	5-1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	7496	C7	120pF 5% Silvered Mica on B4B	7579	L7	Oscillator Coil. 3-10 Mc/s B4A	RF 544
R7	84A ONLY		R41	100K $\Omega$ 4 WATT POTENTIOMETER	7628		2-2pF 5% Silvered Mica on B4A	7488	L8	Oscillator Coil. 1-3 Mc/s B4B	RF 543
	22K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1271	R42	1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.8	6911		80pF 5% Silvered Mica on B4B	7578	L9	Oscillator Coil. 10-30 Mc/s B4A	RF 545
R8	84B ONLY		R43	270 $\Omega$ 1% WATT High Stability	6896		0-51pF 250V. D.C.W. Paper Tub.	10770	L10	Oscillator Coil. 3-10 Mc/s B4B	RF 544
R9	22K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1271	R44	100 $\Omega$ 1% WATT High Stability	6106	C9	0-01pF 350V. D.C.W. Paper Tub.	7491	L11	Oscillator Coil. 30-80 Mc/s B4A	RF 545
	84B ONLY		R45	11 $\Omega$ 1% WATT High Stability	6414	C10	0-01pF 350V. D.C.W. Paper Tub.	7491	L12	Oscillator Coil. 10-30 Mc/s B4B	RF 545
R10	22K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1271	R46	390 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	612	C11	0-01pF 350V. D.C.W. Paper Tub.	7491	L13	R.F. Filter Inductance B4A	C123
	84A ONLY					C12	8pF 450V. D.C.W. Electrolytic	5921	L14	R.F. Filter Inductance B4B	C124
R11	1K10 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9 B4A	1175				C13	16pF 350V. D.C.W. Elec. B4A5	7014	L15	R.F. Filter Inductance B4A	C121
	3-3K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9 B4B	2736					16pF 350V. D.C.W. elec. B4B5	7014	L16	R.F. Filter Inductance B4B	C123
R12	220 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9 B4A	1272				C14	32pF 350V. D.C.W. Elec. B4A6	7014	L17	L.T. R.F. CHDKE	C95
	1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9 B4B	1175					16pF 350V. D.C.W. Elec. B4B5	7014	L18	L.T. R.F. CHDKE	C95
R13	220 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9 B4B	1272					32pF 350V. D.C.W. Elec. B4A6	7014	L19	MAIN S R.F. CHDKE	CB3
	DN B4A CONNECTION IS STRAIGHT TO COIL					C15	0-04pF Miniature Metallized Paper	7485	L20	DUMMY AERIAL INDUCTANCE	
R14	22 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	4419				C16	0-04pF Miniature Metallized Paper	7485	V1	ECC91 (6J6)	7034
R15	1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1175				C17	0-04pF Miniature Metallized Paper	7485	V2	65N7 GT.	5873
	10K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	671				C18	0-01pF M/M 10% Hunts L6/4 (MLV) H994	5803	V3	6X5GT	3150
R17	330K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	4408				C19	0-04pF Miniature Metallized Paper	7485	X1	Silicon Crystal Rectifier. B.T.H. Type C52A	7110
R18	250K $\Omega$ PLESSEY DO3/SER Q.C.	11078				C20	0-05pF Moulded Mica	1524	X3-6	Crystal Diode GE. Westinghouse WG5B	11538
R19	330 $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	7678					0-005pF 750V. D.C. Moulded Mica. B4A6	7131	S1A/D	R.F. Switch	8332
R20	91 $\Omega$ NDN-INDUCTIVELY WOUND PDT.	3754				C21	0-005pF Moulded Mica	1524	S2	A.C. MODULATION SWITCH	7382
	1K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	1175					0-005pF 750V. D.C. Moulded Mica. B4A6	7131	S3	Meter Switch DP/DT. Bulgin S270 CHR/P	6846
R22	1-5K $\Omega$ 10% $\frac{1}{2}$ WATT R.M.A.9	4405				C22	200pF Moulded Mica	7493	S4	ATTENUATOR SWITCH	A29
R23	240 $\Omega$ 1% HIGH STABILITY	5797				C23	300pF Miniature Metallized Paper	7850	S5	MAINS SWITCH	671B
R24	743 $\Omega$ 1% WATT High Stability	6249				C24	10pF 20% Ceramic Disc. B4A ONLY	4274	PL1	Pilot Lamp Type ME5 11mm. 6.5v.	B79
R25	743 $\Omega$ 1% WATT High Stability	6249							T1	MDDULATION TRANSFORMER	MT310
R26	743 $\Omega$ 1% WATT High Stability	6249							T2	MAINS TRANSFORMER	MT309
R27	743 $\Omega$ 1% WATT High Stability	6249								INPUT 110-210-230-250 V.	
R28	120 $\Omega$ 1% WATT High Stability	5798								40-100 c/s on B4A5 & B4B5	
R29	91 $\Omega$ 2% WATT High Stability	6250								INPUT 117V. 25-60 c/s on B4A6	MT 312
R30	91 $\Omega$ 2% WATT High Stability	6250								100uA METER	5880
R31	91 $\Omega$ 2% WATT High Stability	6250									
R32	82 $\Omega$ 2% WATT High Stability	6251									
R33	5K $\Omega$ PRE-SET POTENTIOMETER	5884									

The voltages shown on the circuit diagram were measured on an "Avometer" model 8 [20,000 ohms per volt d.c.]

The 3 Mc/s r.f. measurement was taken on the advance "Advac" a.c. millivoltmeter.

All the measurements were taken with generator set to 3 Mc/s with modulation switched on and set to a depth of 50%

# OPERATING

## MAINS VOLTAGE

The B4A and B4B are normally despatched with the mains transformer set to operate at 220 to 240V, a.c. (40–100 c/s). For other supply voltages, withdraw the instrument from its case by unfastening the fixing screws round the edge of the front panel, unsolder the lead on the 230-volt tag on the mains transformer, and re-solder it to the appropriate tapping point.

With the correct mains voltage applied, the instrument can be switched on. Warming up takes only a few minutes.

## FREQUENCY

Any frequency in the range of the instrument can be selected to an accuracy of  $\pm 1\%$  by means of directly calibrated scales and a band selector switch. A linearly calibrated scale with vernier is also provided to enable high accuracy of re-setting to be obtained. If a given frequency is to be required on a number of occasions, the vernier scale reading should be noted, and when re-setting, the instrument should be set to the reading. Fine frequency adjustment is easily obtained using the double slow motion drive which gives a ratio of 25 : 1. When desired, however, the knob on the main dial may be used to swing from one end of the band to the other.

## R.F. OUTPUT

The r.f. output into a 75 ohm load, or available at the 37 ohm socket of the terminating pad type TP1A, is variable between  $1\mu\text{V}$  and 100mV by means of a continuously variable control and a 5 position 20 dB per step attenuator. The output voltage is monitored at the input to the attenuator (after the continuously variable control) by a crystal voltmeter with an open scale. This method avoids the frequency errors inherent in the continuously variable control.

# INSTRUCTIONS

To read the output voltage, press the switch marked SET MOD-CW into the CW position. The output voltage available into a 75 ohm load or at the 37 ohm socket of the TP1A is the product of the reading of the meter, which is calibrated 0 to 15, and the setting of the step attenuator marked  $X1\mu\text{V}$ ,  $X10\mu\text{V}$ ,  $X100\mu\text{V}$ ,  $X1\text{mV}$ ,  $X10\text{mV}$ .

For accurate reading at the higher frequencies the output line must be correctly terminated, but up to about 5 Mc/s the output voltage may be doubled with slight error by omitting the termination.

When using the 10 ohm socket or the dummy aerial socket on the termination pad, the output voltage is one-tenth of the indicated output.

## INTERNAL MODULATION

The signal can be internally modulated from 0 to 80% at 400 c/s. With the modulation switch set to INT MOD, modulation depth is varied by the MOD control. The modulation depth is monitored when the SET MOD-CW switch is set to MOD. Since the modulation depth is determined by the ratio of modulating voltage to h.t. voltage, it is advisable to maintain accurately the mains input voltage to the generator.

## EXTERNAL MODULATION

The signal can be modulated from an external source up to 80%, the acceptable modulation frequencies being 10 c/s to 30 kc/s into the B4A and 10 c/s to 10 kc/s into the B4B. The upper modulation frequency is limited to 1/30th of the carrier frequency. It is desirable that the mains input voltage is accurately maintained so that the metering is accurate. The external modulating signal is injected into the A.F. socket with the modulation switch set to EXT MOD. Input impedance is high and a d.c. blocking capacitor is incorporated.

## AUDIO FREQUENCY OUTPUT

A signal is available at the A.F. socket from the internal 400 c/s modulating oscillator when the modulating switch is at INT MOD. Approximately 0 to 10 volts is available into 600 ohms, varied by the MOD control. This output is taken from the secondary winding of the modulation transformer and has a low d.c. resistance to earth.

## METER ADJUSTMENT

The monitoring circuits are correctly adjusted before leaving the factory. If after long use they become inaccurate, they can be corrected by means of the preset potentiometers provided. These potentiometers are situated just under the mains transformer.

The most accurate method of adjusting the r.f. metering is by the use of a calibrated crystal voltmeter with input impedance of 75 ohms, which will indicate 100mV. With 100mV into the calibrating meter, the instrument meter reading is adjusted to read 10 (X10mV). An alternative is to adjust the metering at a low r.f. frequency, preferably about 1 Mc/s. The output into a valve voltmeter should be 200mV when the instrument reads 100mV.

The modulation depth indication may be adjusted using an oscilloscope. Care should be taken to avoid errors due to the distortion of the oscilloscope amplifiers. It may be preferred to use the cathode ray tube plates directly, obtaining the deflecting voltage by loose coupling to the tuning capacitor.

## SIGNAL GENERATOR—TYPE B4AC

### Amendments to Handbook

- Page 2 Reference to 75 ohms impedance should read 50 ohms.
- Page 2 Reference to 37 ohms impedance should read 25 ohms.
- Page 3 Termination Pad type TP1A is replaced by TP1C.
- Page 3 RF lead PL5 is replaced by PL43.
- Page 3 AF lead PL18 is replaced by PL18/C.

Circuit Diagram R43 is 91 ohms PN.372

R23 is 162 ohms PN.362

R24 is 490 ohms PN.365

R25 is 490 ohms PN.365

R26 is 490 ohms PN.365

R27 is 490 ohms PN.365

R28 is 56 ohms PN.364

R29 is 62 ohms PN.363

R30 is 62 ohms PN.363

R31 is 62 ohms PN.363

R32 is 82 ohms PN.6251